Proceedings of the British Academy, **82**, 1–35

ALBERT RECKITT ARCHAEOLOGICAL LECTURE

Archaeology and Modern Human Origins in Europe

PAUL MELLARS
University of Cambridge
Fellow of the Academy

THE PERIOD CENTRED ON 40–30,000 BP witnessed two radical developments in the prehistory of Europe. The first was the effective replacement —by whatever mechanisms—of the biologically 'archaic' or 'Neanderthal' populations who had occupied Europe for the preceding 200,000 years or so, by populations who were in at least most anatomical respects almost identical to ourselves (the so-called 'Cro-Magnon' populations). The second was a spectrum of dramatic changes in human cultural and behavioural patterns which, in archaeological terms, define the conventional transition from the 'Middle Palaeolithic' (or 'Mousterian') to the 'Upper Palaeolithic' periods. Arguably, this complex of changes marks by far the most significant development in the human history of Europe since the initial colonization of the continent by early *Homo erectus* populations almost a million years ago (Clark 1981).

Reduced to their simplest terms—and stripped of some of the more emotive overtones which have emerged in some of the recent literature—the major questions posed by this transition can perhaps be summed up as follows:

1 What was the precise character of the behavioural changes documented over this time range, and what do these changes signify in more general cultural or behavioural terms?
2 How far can this transition be attributed to a process of gradual, *in situ* change in human biological and behavioural patterns, and how far does it reflect a major dispersal (and ultimately perhaps replacement) of human populations over the different regions of Europe?

Read at the Academy 5 December 1991.

3 If there *is* persuasive evidence (as many archaeologists believe) for an actual dispersal of new populations over Europe at this point in the archaeological sequence, then how far can we recognize evidence for any patterns of contact or interaction between the new, expanding populations of 'anatomically modern' humans, and the indigenous 'archaic' populations within the different regions?

4 Finally, why should we encounter this particular pattern of combined biological and behavioural change at this particular point in the archaeological sequence—i.e. at a point roughly midway during the last glaciation, and at a time when at least the more northerly parts of Europe were in the grip of a severe, periglacial type of climate?

It is just over ten years since these issues were addressed by Professor J. Desmond Clark in a breathtakingly wide-ranging paper presented to the British Academy in 1981 ('New men, strange faces, other minds; an archaeologist's perspective on recent discoveries relating to the origins and spread of modern man': Clark 1981). If my conclusions differ in certain respects from his, this is simply a reflection of the remarkable speed with which research into this field has progressed over the past decade, and the discoveries which have accumulated in the meantime. The scope of my own paper of course is more restricted than that adopted by Professor Clark, and will focus specifically on the evidence from the European continent. As will hopefully become clear, however, the data from Europe provide not merely a critical case study for some of the more *general* issues of modern human origins which have recently provoked so much debate in the archaeological and anthropological literature, but one from a region where the relevant evidence—both biological and archaeological—is particularly well documented and clearly defined. Our concern with the origins of modern human populations in Europe therefore reflects something more than a purely parochial interest.

The Character of the Behavioural Transition

Arguably the most striking feature of the conventional Middle-to-Upper Palaeolithic transition is the wide range of different aspects of behaviour which seem to have been affected (Mellars 1973, 1989a, 1989b; White 1989; Kozlowski 1990). The changes range, apparently, into all spheres of culture—the technology of tool production, various forms of symbolic expression, food procurement patterns, demography, social organization and (almost certainly) into the more fundamental realms of communication and the related 'cognitive' structures of the human groups.

In the realm of technology, for example, we can document not only

radical changes in the basic technology of production of stone tools (apparently based, in the Upper Palaeolithic, on extensive use of 'indirect percussion' or 'punch' techniques, for the production of elongated, regular blades) but also a rapid proliferation in the precise *forms* of the tools produced by these new blade techniques. Typical end scrapers, several forms of burins, and even more varied forms of small (often microlithic) backed blade forms all emerge relatively suddenly during the earliest stages of the Upper Palaeolithic sequence and would seem to reflect equally rapid changes in many of the other, directly related aspects of technology, such as the working of skins, the shaping of wood and bone, and the appearance of new forms of hunting equipment (Mellars 1989b; Kozlowski 1990). Equally if not more striking changes are apparent in the production of bone, antler and ivory artefacts. Even if some very simple forms of bone tools are not entirely unknown in preceding Middle Palaeolithic contexts, the remarkable range, complexity and explicit *standardization* of the bone tools which appear during the initial stages of the Upper Palaeolithic sequence are totally without parallel in the earlier periods (Bosinski 1990). Arguably most striking of all is the rapidity with which these different forms of stone and bone artefacts change, both at different stages throughout the Upper Palaeolithic succession, and in different geographical regions. Collectively, this complex of purely technological changes in the production of stone and bone artefacts seems to reflect a radical departure in the whole tempo of human technological development, with a pattern of rapid and radical innovations in tool production which is unknown in the preceding periods.

How far similar changes can be identified in the patterns of economic and social organization of the human groups remains, perhaps, slightly more controversial. It has often been pointed out, however, that many sites of the Upper Palaeolithic period (including those of the earliest stages, reaching back to at least 34,000 BP) seem to reveal a far more sharply focused and apparently 'specialized' pattern of exploitation of certain particular species of animal than anything which can at present be documented during the preceding Middle Palaeolithic. This is reflected most strikingly, perhaps, in the exploitation of reindeer within the extreme western zones of Europe, where this species can frequently account for up to 95–99 per cent of the total faunal assemblages recovered from early Upper Palaeolithic levels (Mellars 1989a). There is equally clear evidence that in at least many regions of Europe the overall numbers of occupied sites increase sharply during the earlier stages of the Upper Palaeolithic sequence, in a way which points strongly if not incontrovertibly to a substantial increase in overall population densities over this period (Mellars 1973; White 1982). The combination of these changes with the appearance

of seemingly much larger—and certainly more highly 'structured'—occupation sites, points equally strongly to some significant changes in the underlying social structure and organization of the local groups (Mellars 1973, 1989a; Gamble 1986).

Lastly—and by far most dramatically—there is evidence for what has often been described as a veritable 'explosion' in explicitly symbolic expression over the period of the Middle-Upper Palaeolithic transition (e.g. Pfeiffer 1982; White 1989). Debates continue as to whether the occasional specimens of scratched or 'incised' bones, and the even more occasional specimens of perforated bones, recovered from Mousterian sites could reflect some simple and rudimentary forms of symbolic expression among Neanderthal groups (Marshack 1972, 1990; Chase & Dibble 1987; Bednarik 1992). What is not in doubt is that all of these *potential* manifestations of symbolic behaviour effectively erupt during the initial stages of the Upper Palaeolithic sequence in a remarkable diversity of

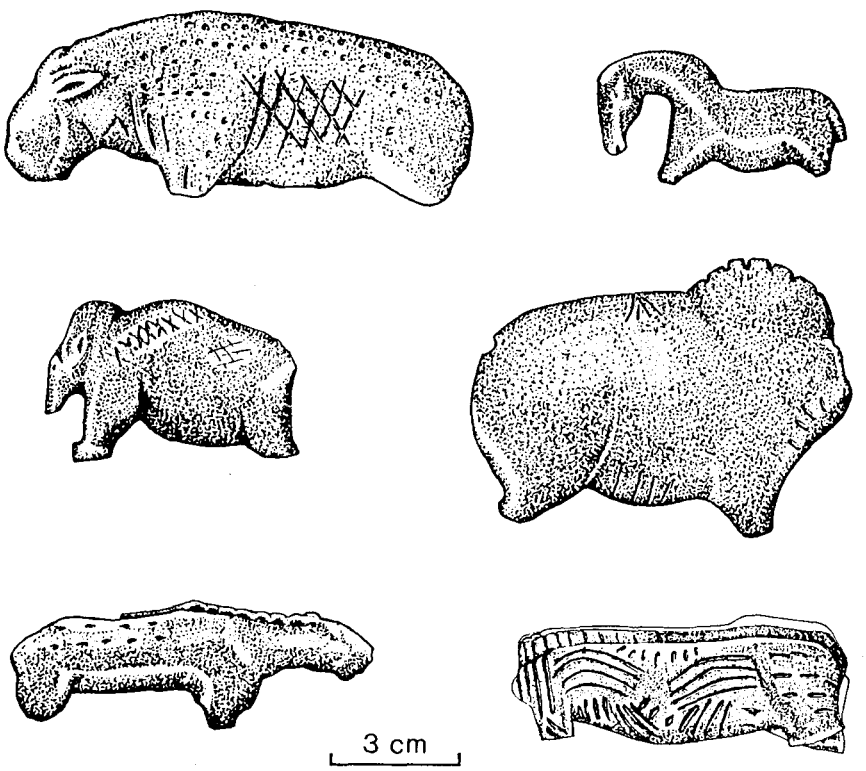

Figure 1. Animal figurines carved from mammoth ivory, from the Aurignacian levels (ca. 30–34,000 BP) in the Vogelherd Cave, south Germany.

forms—in the form of carefully perforated (and in many cases deliberately *shaped*) beads and other pendants; in the complex patterns of linear and geometrical markings encountered on bone and ivory artefacts; in the large-scale trading of various species of small, decorative sea shells over extensive areas of Europe; and—above all—in the remarkably varied and sophisticated forms of explicitly representational art, which have now been documented from a range of early Upper Palaeolithic sites in both Western and Central Europe (Hahn 1972, 1977; Delluc & Delluc 1978; Mellars 1973, 1991; White 1989; Marshack 1972, 1990). If a single demonstration were required for this remarkable 'symbolic revolution' at the start of the Upper Palaeolithic period, then the astonishing lion-headed human figure recovered from the early Aurignacian levels in the Höhlenstein-Stadel cave in south Germany (Fig. 2) and the equally remarkable animal statuettes carved out of mammoth ivory from the nearby site of Vogelherd (Fig. 1) —all clearly dated to more than 30,000 BP—would seem to provide this evidence in a particularly impressive and beautiful form (Bosinski 1990).

The question of what this wide spectrum of behavioural changes implies in more fundamental cultural or 'cognitive' terms remains, perhaps, one of the most intriguing and controversial aspects of the archaeological record. In common with several other prehistorians (e.g. Binford 1989; Davidson & Noble 1989; Clark 1992) I would argue that the clue to understanding this particular question lies in the evidence for the sudden and dramatic proliferation of explicitly *symbolic* expression at the start of the Upper Palaeolithic sequence. To most archaeologists and anthropologists it seems entirely inconceivable that these rich, varied and seemingly ubiquitous reflections of symbolic behaviour could be achieved without the accompaniment of relatively complex—and most probably essentially 'modern'—patterns of linguistic communication. Indeed, the entire spectrum of Upper Palaeolithic behaviour and culture has a remarkably 'modern' feel (in anthropological terms) which would be hard to visualize without the kind of structures and subtleties of communication which only relatively advanced forms of language could provide (Binford 1989; Mellars 1989a, 1991; Whallon 1989; Clark 1992). On this point at least there is almost universal agreement. Whether or not equally complex forms of language were present among the preceding Neanderthal communities in Eurasia remains far more controversial. A number of anthropologists such as Lieberman, Laitman and others have argued against the presence of fully-developed language in Neanderthal groups on purely biological grounds—i.e. on the grounds that the detailed morphology of the basal region of Neanderthal skulls and associated mandibles would militate against the ability to form a full range of vowel sounds, and therefore seriously impede the intelligibility of the 'language' produced

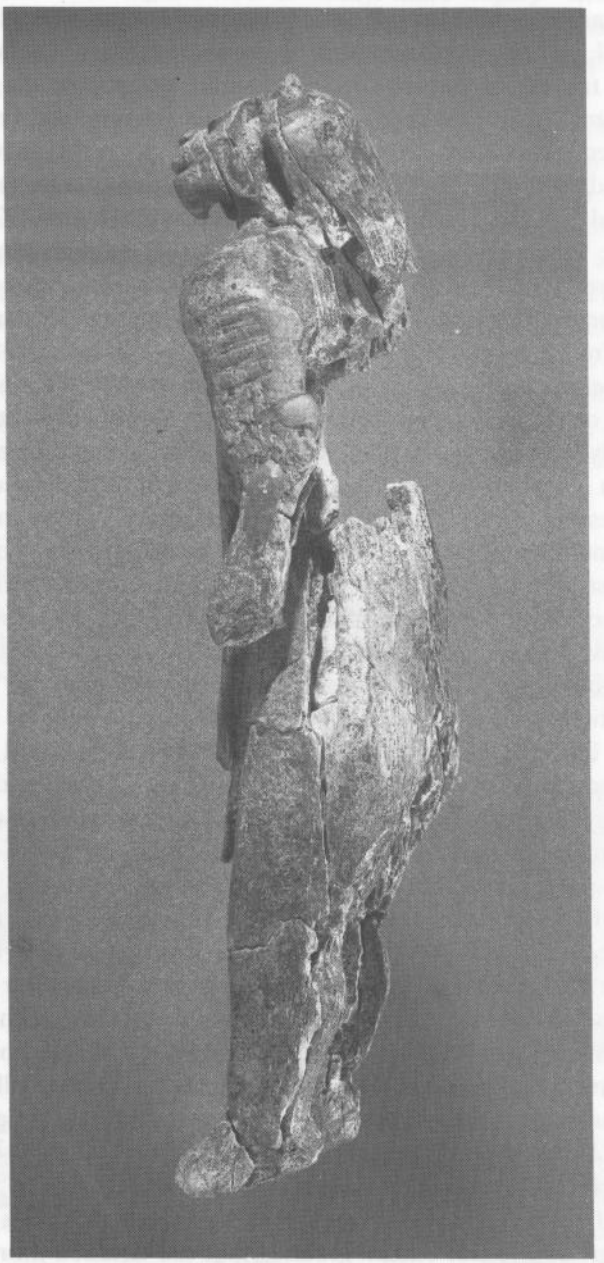

Figure 2. Lion-headed human figure of mammoth ivory from the early Aurignacian levels in the Höhlenstein-Stadel Cave, south Germany (ca. 30–34,000 BP) (Photo kindly supplied by A. Marshack).

(e.g. Lieberman 1989, 1990). All of these arguments of course remain controversial, and contested by other workers (e.g. Ahrensburg 1989). My own argument, more simply, would be that the entire character of the documented behavioural and cultural transition from the Middle to the Upper Palaeolithic periods would seem to imply some kind of dramatic change in the basic structure and patterning of human cultural and symbolic expression, of the kind which the emergence of complex, essentially *modern* language patterns could most easily explain (Mellars 1989b, 1991). Clearly, none of these arguments at present amounts to more than speculation, and we must no doubt accept that, in the final analysis, the character and structure of language remains largely beyond the realm of purely archaeological inference. Nevertheless some radical and far-reaching change is clearly required to explain the dramatic spectrum of behavioural changes which characterizes the start of the Upper Palaeolithic succession—above all, the demonstrable explosion in complex *symbolic* expression—and in the present state of research the emergence of more complex, more structured, and more 'efficient' language patterns would arguably provide the most economical and plausible explanation for this revolution (see also Bickerton 1990; Clark 1992).

Population Replacement

The issue of population continuity versus population replacement has formed the core of the debate over the transition from anatomically 'archaic' to anatomically 'modern' human populations throughout the greater part of the present century—effectively since the original publication of the classic Neanderthal skeleton from La Chapelle-aux-Saints by Marcellin Boule in 1909. Throughout this period it could be said that opinions have tended to polarise between two extremes—i.e. between those who saw the appearance of anatomically modern populations (i.e. *Homo sapiens sapiens*) as representing a major 'colonization' event deriving initially from one geographical centre and subsequently dispersing throughout all areas of the world (the so-called 'Garden of Eden' hypothesis); and those who saw this event as reflecting a much more gradual and localized process of long-term evolutionary development within each region of the world, effectively without any significant dispersal or replacement of populations (the 'multiregional evolution' hypothesis) (Spencer 1984; Stringer & Andrews 1988; Smith 1991). A spate of publications over the past five years shows that opinions on this issue remain no less sharply divided now than they were 20 or even 50 years ago (e.g. Stringer & Andrews 1988; Stringer 1990; Wolpoff 1989; Thorne & Wolpoff 1992; Wilson *et al.* 1992).

There can be little doubt that over the past decade a number of discoveries have tended to shift the overall balance of the evidence some way in favour of the population dispersal hypothesis. Without attempting to summarize the deluge of literature which has recently appeared on this topic, it is clear that two developments have been especially critical in this regard. On the one hand there has been the work carried out on the 'genetic finger-printing' of present-day human populations in different regions of the world, based particularly on the patterns of variation of both nuclear and mitochondrial DNA. In particular, the research carried out by Allan Wilson, Rebecca Cann, Mark Stoneking and others on the patterns of mitochondrial DNA (which are known to be inherited exclusively through the female line of descent, and are apparently subject to an unusually rapid rate of genetic mutation) is claimed to point to a surprisingly recent point of origin for the whole of the present-day world populations, probably reaching back no more than (at most) ca. 200–500,000 years (Cann *et al.* 1987; Stoneking & Cann 1989; Wilson & Cann 1992; Stoneking *et al.* 1992). Combined with the results of similar studies of patterns of nuclear DNA (in this case inherited through both the male and female lineages: Lucotte 1989; Wainscoat *et al.* 1989; Mountain *et al.* 1992) the genetic evidence as a whole would point to Africa as the most likely point of origin of these genetically 'modern' populations—although other potential homelands centred further to the north and east in Asia have also been debated in the literature (cf. Maddison 1991; Templeton 1993). The second crucial development has come from recent advances in absolute dating techniques (especially those of thermoluminescence and electron-spin-resonance dating), which now make it possible to attribute relatively secure relative and absolute ages to a number of critical discoveries of human skeletal remains whose ages had previously remained highly controversial (Aitken *et al.* 1992). Perhaps the most important single development in this context has been the recent dating (by two separate dating techniques) of the large samples of anatomically modern skeletal remains from the two sites of Mugharet-es-Skhul and Djebel Qafzeh in Israel to around 90–110,000 BP (Bar-Yosef 1992). The critical implication of this dating is that human populations that were essentially 'modern' in at least the majority of anatomical respects had become established in the Middle Eastern region at least 50–60,000 years before their appearance in the more northerly regions of Europe and Asia, and must therefore have coexisted (in a broad sense) alongside the various Neanderthal and other 'archaic' populations of these regions over at least this span of time (Vandermeersch 1989). Combined with the dating of a range of broadly similar anatomically modern hominids at a number of sites in southern Africa (e.g. Omo, Border Cave, Klasie's River Mouth) to a broadly similar

date, this is clearly consistent with the basic implications of the 'Out of Africa' model, and much less consistent with the implications of the 'multiregional evolution' hypothesis (Stringer & Andrews 1988; Stringer 1990; Brauer 1989).

One final development which has a particularly critical bearing on the interpretation of the evidence from Western Europe is the discovery of human skeletal remains at the site of Saint-Césaire in the Charent-Maritime Department of western France. Although fragmentary, reconstruction of these remains produced a largely complete skull which is now generally accepted as being in all essential respects of 'classic' Neanderthal type (Lévèque & Vandermeersch 1980) (see Figure 4). The critical importance of this discovery lies in its dating. From a variety of lines of evidence (archaeological associations, stratigraphy, pollen analysis, and a number of direct thermoluminescence measurements on associated burnt flint samples) it is now clear that this skull must date from no earlier than ca. 35–38,000 BP (Mercier *et al.* 1991). As such, the remains can hardly be more than (at most) ca. 3000–5000 years older than the earliest well documented specimens of fully 'Cro-Magnon' forms in Western Europe—as represented for example at Vogelherd in Germany, Les Rois in western France, and indeed Cro-Magnon itself (see below). The argument, quite simply, is that it seems virtually inconceivable that the human population represented by the Saint-Césaire remains could have evolved into populations of fully modern skeletal form—within the time-span available—without at least some massive component of external gene-flow, which would have effectively swamped the genetic and anatomical features of the local Neanderthal populations. Even the most ardent proponents of the population continuity hypothesis seem to accept that the characteristics of the Saint-Césaire skeleton point strongly to at least some major element of population influx into these extreme western fringes of Europe (Smith 1991).

Needless to say, most of these discoveries have been challenged in various ways by proponents of the multiregional evolution school—as least as regards the specific interpretations which have been drawn from the genetic and skeletal evidence. Wolpoff, Thorne and others, for example, have challenged the chronological interpretations of the mitochondrial DNA evidence, and have argued that by adopting a rather different rate of genetic divergence in DNA patterns one could redate the inferred dispersal of 'modern' populations from the presumed African homeland to around 900,000 BP—i.e. close to the generally accepted date for the *initial* dispersal of *Homo erectus* populations into northern latitudes in the early Pleistocene (Wolpoff 1989; Thorne & Wolpoff 1992). Wolpoff, Thorne, Smith and others have also contested the interpretation of the

skeletal evidence, arguing that many of the supposed dichotomies which have been set up between anatomically 'archaic' and anatomically 'modern' populations (as for example in Africa and the Middle East, and indeed in parts of Europe) simply fail to make due allowance for the probable scale of individual anatomical variation *within* the local populations (e.g. Smith 1991). They also argue that in certain other regions (most notably southeast Asia, Australasia and parts of Central and Eastern Europe) there would seem to be strong indications in the skeletal evidence itself for some component of direct genetic continuity between the latest archaic and earliest anatomically modern populations (Thorne & Wolpoff 1992). Finally, and potentially most seriously, there have been a number of recent criticisms of the statistical calculations which underlie the interpretation of much of the recent mtDNA and other genetic evidence, and which could, potentially, be used to support the more general implications of the 'multiregional evolution' view (Maddison 1992; Templeton 1993).

Taking a broad view, there is little doubt that many of the current controversies in the interpretation of the available genetic and anatomical evidence stem largely from the attempt to adopt a single, unified view for the emergence of anatomically modern populations which is applicable to all areas of the world, regardless of the character of local geographical and environmental circumstances, or the particular trajectories of demographic and evolutionary development within each region. Fortunately, the issues in the present context are rather simpler. The question in this case concerns simply the European evidence and, in particular, that from the more western zone of Europe. Having already looked briefly at the basic biological and skeletal arguments in this context, I now wish to focus specifically on the bearing of the available *archaeological* evidence on the character of this transition. The question, quite simply, is how far the available archaeological evidence can be used to argue forcibly either for or against the notion of a rapid dispersal of entirely new human populations across the different regions of Europe, associated with the earliest appearance of 'anatomically-modern' morphology in these areas.

As I have recently discussed in more detail elsewhere (Mellars 1992) all of the current arguments in this particular debate hinge fairly centrally and pivotally on one critical correlation—namely, the assumption that all of the earliest and most securely documented specimens of fully 'modern' anatomy in Europe are associated with one specific archaeological entity —i.e. with the grouping of so-called 'Aurignacian' industries (Figure 3). Leaving aside some of the more controversial specimens, well documented associations of this kind have now been recorded from at least four or five separate localities in Europe—notably from Vogelherd (i.e. Stetten) in Germany, from Mladec in Czechoslovakia, Velika Pecina in Yugoslavia,

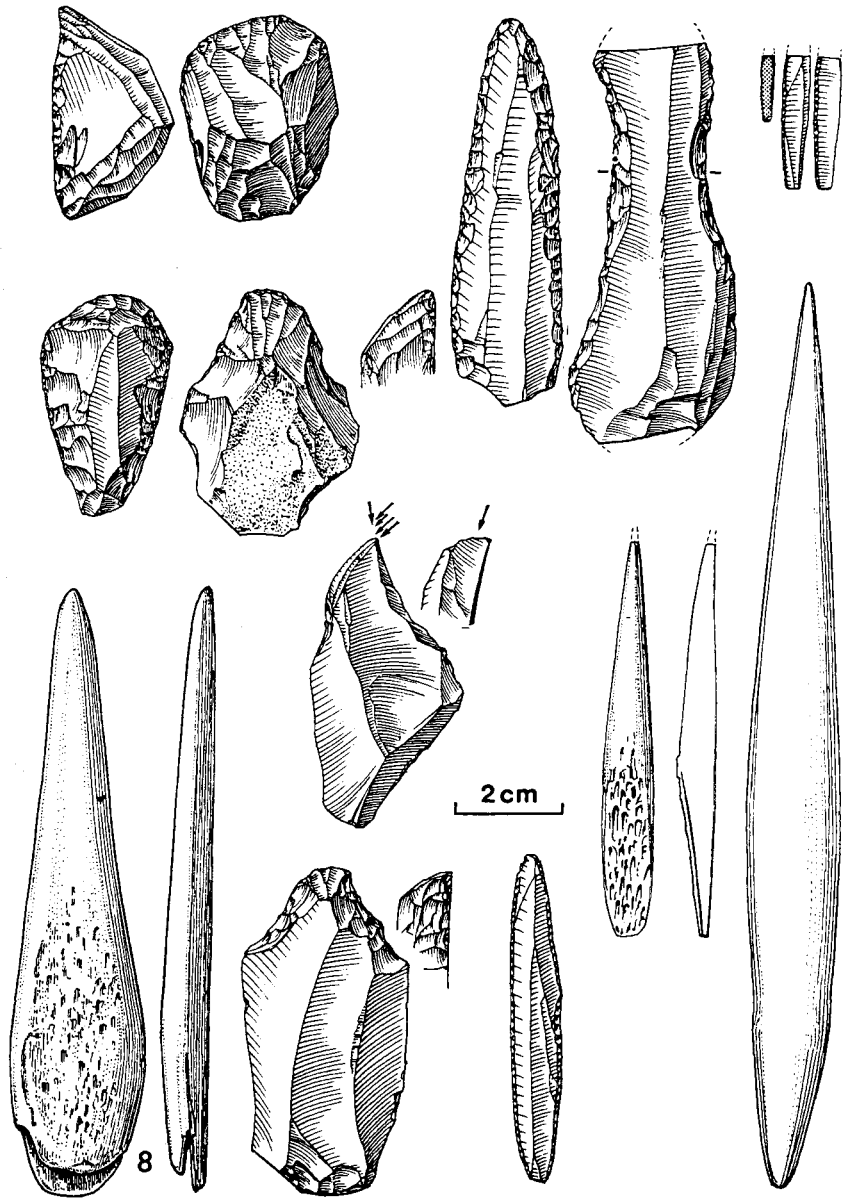

Figure 3. Aurignacian stone and bone artefacts from sites in western France (after Bordes 1968).

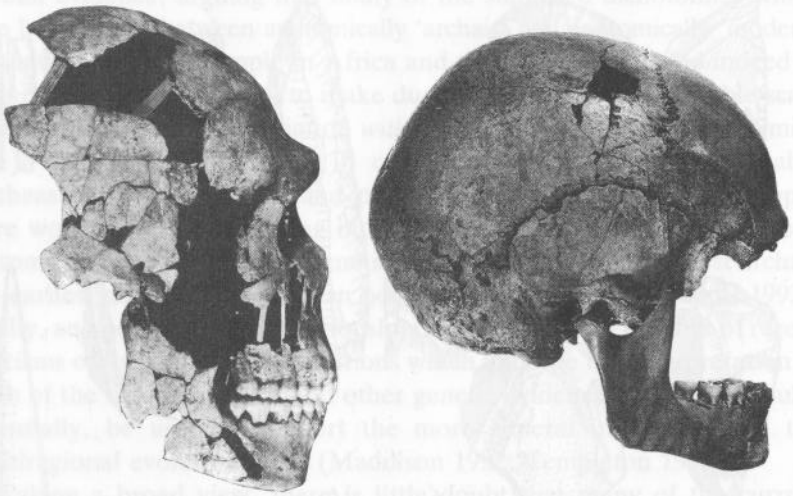

Figure 4. Left: Neanderthal skull from the Châtelperronian levels (ca. 35,000 BP) at Saint-Césaire (Charente-Maritime, southwest France); Right: skull of anatomically modern form from Vogelherd (Stetten), south Germany (ca. 30–34,000 BP) (after Brauer 1989).

and Les Rois and (perhaps slightly less certainly) Cro-Magnon in western France (Smith 1984; Stringer *et al.* 1984; Gambier 1989; Hublin 1990) (Figure 4). Certainly, no serious claim has ever been made for an association between typically Aurignacian assemblages and anatomically Neanderthal remains in Europe. If this critical correlation is accepted, then the whole of the archaeological aspect of this particular debate hinges on the specific origins and mutual interrelationships of these Aurignacian industries within the different regions of Europe. Specifically, do these industries appear to reflect the dispersal of an entirely *new* human population over the different parts of the continent? Or do they reflect simply a diversity of essentially *local* patterns of technological and demographic development, stemming directly from the immediately preceding Middle Palaeolithic/Neanderthal populations within each region? The most relevant observations in this context can be summarized as follows (Mellars 1992):

1 Archaeologically, one of the most striking features is the remarkable uniformity of Aurignacian technology, extending not only across effectively the whole of Eastern, Central and Western Europe, but also into at least the northern parts of the Middle East—in all a span of over 4000 kilometres (Figure 5). As François Bordes (e.g. 1968: 200) and others have emphasized, industries recovered from sites such as Ksar Akil in Lebanon and Hayonim and Kebara in Israel are virtually indistinguishable in most

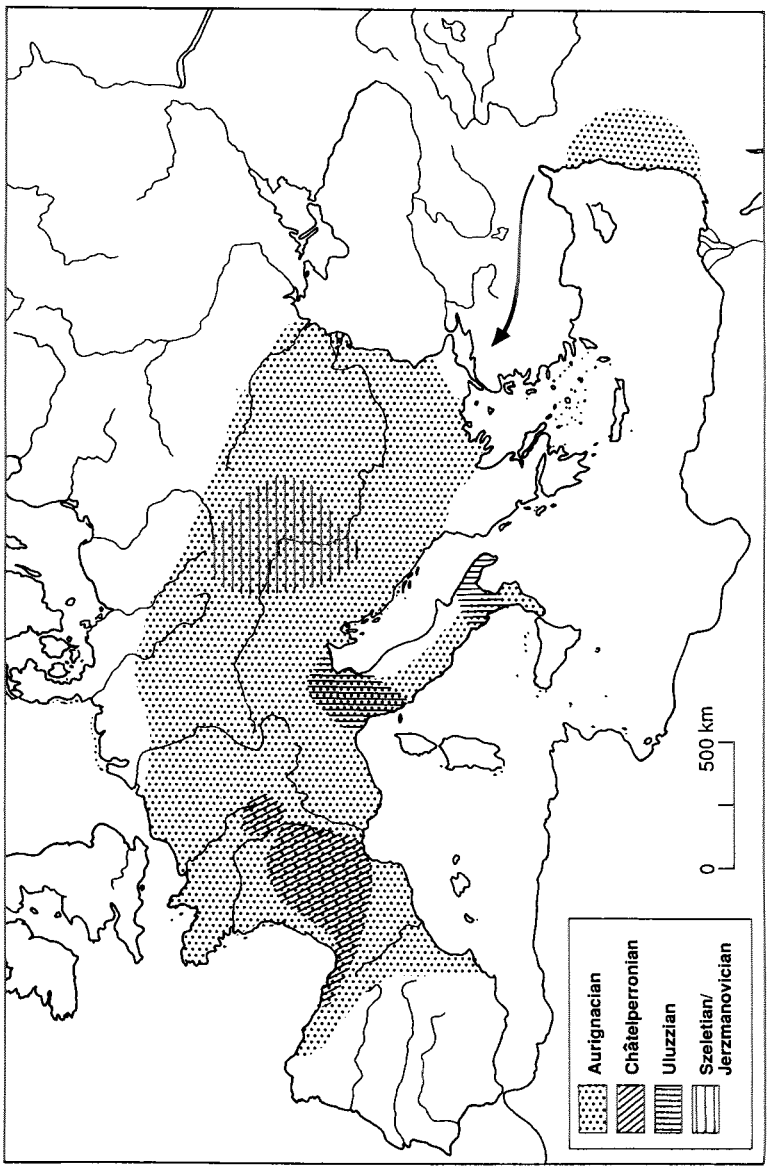

Figure 5. Geographical distribution of Aurignacian industries in Europe and the Middle East, compared with the distribution of Châtelperronian, Szeletian and Uluzzian industries. In addition to the distribution shown, further occurrences of Aurignacian technology have been reported from Portugal, Britain, Sicily, southern Russia and Afghanistan.

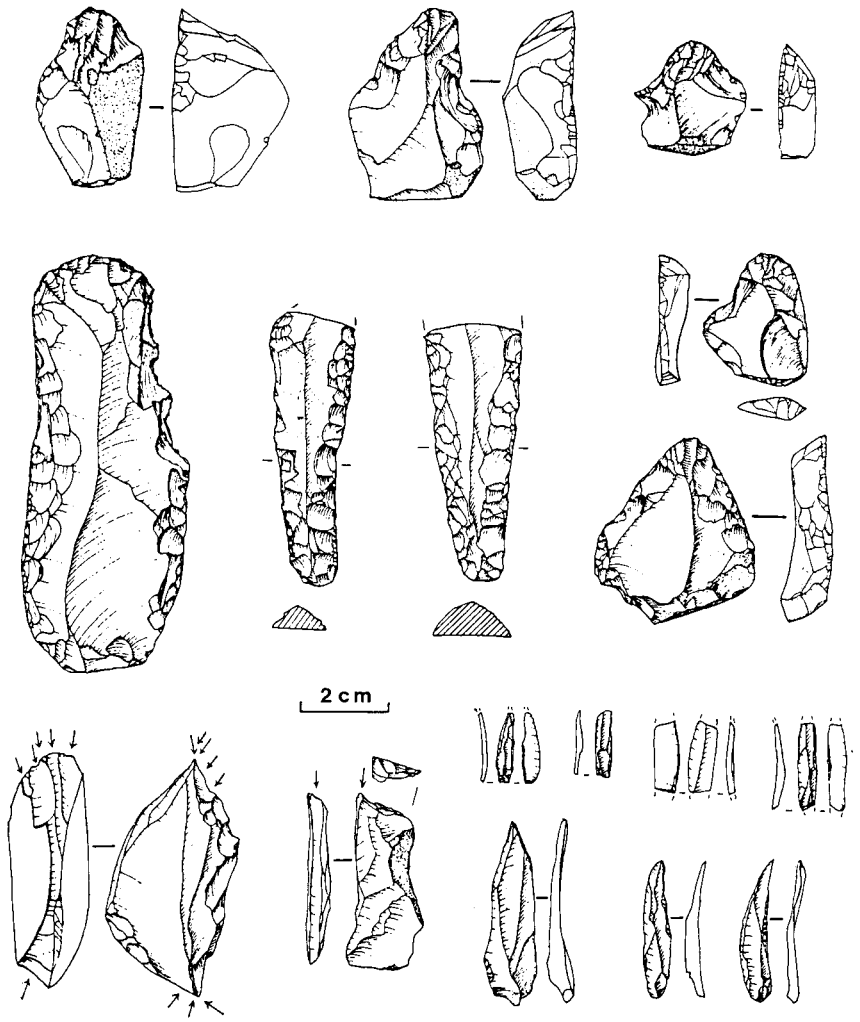

Figure 6. Aurignacian tools from the Hayonim Cave (Israel) showing a range of forms closely similar to those from Aurignacian sites in Western and Central Europe.

respects from those recovered from many of the classic Aurignacian sites in western Europe—reflected not only in the detailed typology of the stone tools (Figure 6), but even more strikingly in some of the highly distinctive and idiosyncratic forms of bone and antler tools—such as typical 'split-base' and 'biconical' bone points (Bar-Yosef & Belfer-Cohen 1988). At no other point in the Upper Palaeolithic sequence can one demonstrate such a remarkable uniformity in technology, extending over such a wide

diversity of contrasting environmental and ecological zones. Whether or not this uniformity would have been possible without a similar uniformity in language patterns across this broad region remains, no doubt, an interesting point for speculation (cf. Cavalli-Sforza 1991).

2 This striking uniformity in the technology of the earlier Aurignacian industries contrasts sharply with the remarkable diversity of the immediately preceding Middle Palaeolithic technologies in the different regions of Europe. As Kozlowski (1992) and others have emphasized, the final stages of the Middle Palaeolithic in Europe seem to have been characterized by a wide variety of technological patterns: typical 'Mousterian of Acheulian tradition' industries (characterized by small heart-shaped handaxes) on the extreme western fringes of the continent; various forms of either 'leaf-point' or 'eastern Charentian' industries in Central and Eastern Europe; 'Denticulate' industries (apparently) in parts of Italy and northern Spain; and a variety of either Levallois or Levallois-point dominated technologies in the Balkans and south-eastern Europe. It is arguably difficult, if not impossible, to see how a technology as remarkably uniform and widespread as the Aurignacian could have sprung—rapidly and essentially independently—from such a wide diversity of technological roots.

3 The point now seems to be generally accepted that it is in fact extremely difficult to find convincing origins for the distinctive patterns of Aurignacian technology within at least most regions of Europe. This point has been emphasized by (among others) Kozlowski (1982, 1992) for the Balkans and southeast Europe; by Allsworth-Jones (1986), 1990), Otte (1990) and others for Central Europe; by Mussi (1990) and Goia (1990) for Italy; by Bordes (1968), de Sonneville-Bordes (1960), Demars (1990) and others for western France; and by Bischoff *et al.* (1989) for nothern Spain. In all these areas (as noted above) the earliest Aurignacian industries would seem to appear as a relatively sudden and abrupt break in the local patterns of technological development, with no apparent links with the immediately preceding Mousterian industries in the same regions. Only very rarely has the possibility of purely local origins been suggested for Aurignacian technology in Europe, as for example by Cabrera Valdes and Bernaldo de Quiros (1990) for the succession at Castillo in northern Spain, and by Valoch (1983) for some of the Czechoslovakian industries. Both of these suggestions however have been contested by other workers, and have since been withdrawn by Valoch himself (1990) for the Czechoslovakian industries.

At present the most plausible origins for Aurignacian technology would seem to lie within some of the industries in the Middle East—most notably

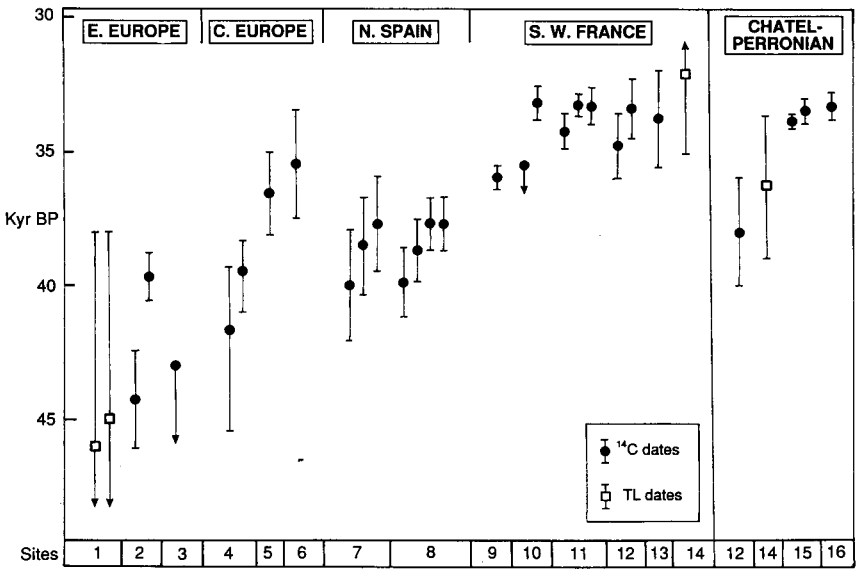

Figure 7. Absolute age measurements for early Aurignacian industries in Eastern, Central and Western Europe, and for Châtelperronian industries in France. For the radiocarbon dates (indicated by circles) the graph includes only the *oldest* dates available from each region, on the assumption that these are likely to show patterns least affected by problems of contamination with more recent, intrusive carbon. Vertical bars indicate one standard deviation; vertical arrows indicate 'greater than' ages. The sites shown are: 1. Temnata (Bulgaria); 2. Istállóskö (Hungary); 3. Bacho Kiro (Bulgaria); 4. Willendorf (Austria); 5. Geissenklösterle (Germany); 6. Krems (Austria); 7. Castillo (N.W. Spain); 8. L'Arbreda (N.E. Spain); 9. La Rochette (France); 10. La Ferrassie (France); 11. Abri Pataud (France); 12. Roc de Combe (France); 13. Le Flageolet (France); 14. Saint-Césaire (France); 15. Arcy-sur-Cure (France); 16. Les Cottés (France). The dates are taken from the following sources: Allsworth-Jones 1986; Bischoff *et al.* 1989; Cabrera-Valdes & Bischoff 1989; Delibrias & Fontugne 1990; Haesaerts 1990; Kozlowski 1982, 1992; Leroi-Gourhan & Leroi-Gourhan 1964; Mellars 1990a; Mellars *et al.* 1987; Mercier *et al.* 1991; Movius 1975. Note that radiocarbon dates in this age range are likely to be systematically younger than those produced by other dating techniques, perhaps by ca. 3000 years (Bard *et al.* 1990). The precise taxonomy of the industries from Willendorf (site 4) remains to be clarified.

perhaps in the long sequence of Aurignacian, proto-Aurignacian and so-called 'transitional industries recorded at Ksar Akil in the Lebanon (Copeland 1976; Marks & Ferring 1988; Ohnuma & Bergman 1990). Significantly, it is in this region—in contrast to the various regions of Europe—that the earliest Aurignacian industries can be seen to be preceded by a long succession of demonstrably *earlier* Upper Palaeolithic technologies, apparently extending back to at least 45–50,000 BP (Marks & Ferring 1988; Mellars & Tixier 1989).

4 The relative and absolute chronology of the earliest stages of the

Aurignacian within the different regions of Europe still remains to be documented in really secure terms—largely owing to the inherent limitations of radiocarbon dating within this age range. The overall pattern of the available dates (Figure 7) would nevertheless appear to suggest a pattern of successively younger dates extending progressively from east to west across the continent—ranging from around 43–45,000 BP in eastern and southeastern Europe, through to ca. 40,000 BP in northern Spain and the Mediterranean coast, to around 35,000 BP in the 'classic' region of southwestern France (Kozlowski 1992; Mellars 1992). There is clearly an urgent need for more dates to confirm this pattern, preferably with methods other than radiocarbon. As the evidence stands at present, however, it could be argued to be at least consistent with the hypothesis of a progressive spread of Aurignacian technology essentially from east to west across the continent.

5 Finally, the character and scale of the various technological and other behavioural innovations which appear to be associated specifically with the earlier stages of the Aurignacian in the different regions of Europe should be re-emphasized—ranging from innovations in both the technology and typology of stone tool production, through the emergence of complex and extensively shaped bone, antler and ivory artefacts, to the effective 'explosion' of a wide range of explicitly symbolic artefacts in the form of notched and incised bonework, a variety of personal ornaments, and remarkably varied and sophisticated forms of representational art. Even if we set aside the evidence for apparent shifts in the overall densities of human population, patterns of animal exploitation, and the sizes of local social and residential groups, this is an impressive range of behavioural innovations which (as argued above) almost certainly reflects a range of equally radical changes in the social, cognitive and (most probably) linguistic patterns of the associated populations. Of course, radical and wide ranging behavioural innovations of this kind cannot be taken as an *automatic* reflection of episodes of population dispersal or replacement in the archaeological record, since it is clear that under certain conditions episodes of rapid behavioural change can occur either through processes of simple cultural diffusion, or indeed through rapid and multivariate patterns of purely internal cultural change. Nevertheless, the point hardly needs labouring that the close association of all these behavioural innovations with the first appearance of Aurignacian technology—and apparently with the first appearance of fully 'modern' skeletal anatomy—within the different regions of Europe, is at least consistent with the hypothesis of an actual population dispersal at this point in the archaeological sequence, even if the archaeological evidence cannot be held up—in isolation—as conclusive proof of this.

From the various lines of evidence outlined above it could be argued that the total spectrum of the archaeological evidence for the Aurignacian within the different regions of Europe coincides closely, if not precisely, with the pattern that one would reasonably predict from the implications of the current population-dispersal scenarios of modern human origins. Whether the same body of data could be held to be equally consistent with the population-continuity or 'multiregional evolution' hypothesis is much more open to debate. How in this case would one account for the striking uniformity of Aurignacian technology over such a vast area of Europe and the Middle East, superimposed on so much diversity in the technology of the immediately preceding Middle Palaeolithic populations in the same regions? How would one explain the sudden and apparently abrupt way in which this technology appears in so many different regions without, apparently, any clear or convincing origins or antecedents in the preceding technologies in the same areas? Or indeed the sheer range, diversity and magnitude of the various cultural and behavioural innovations involved? In the classic region of western France at least there can no longer be any serious dispute that the appearance of the Aurignacian reflects the intrusion of a new human population—reflected not only in the totally sudden and abrupt appearance of this technology (clearly *later* than its appearance in the immediately neighbouring areas of northern Spain and the Mediterranean coast) but also in the explicit evidence that the earliest Aurignacian communities in this area clearly persisted (and apparently *coexisted*) for some time alongside the latest Mousterian/Neanderthal populations in the same region—as discussed further below (cf Mellars 1989a; Demars & Hublin 1989). If we accept this kind of population intrusion within the fully documented region of southwest France, we should presumably be prepared to give the same hypothesis equal consideration in the other regions of Europe, where the overall spectrum and character of the archaeological evidence appears to show a broadly similar pattern.

Population Interraction

The preceding discussion raises one of the most intriguing issues posed by the whole of current studies of the origins and dispersal of biologically modern human populations—that is, how far can we identify evidence for any patterns of contact or interraction between the final Neanderthal populations and the earliest—hypothetically intrusive—populations of anatomically modern humans within the different regions of Europe. If there is indeed any validity in the current population-dispersal scenario,

then of course there is no way that this particular issue can be avoided. The direct and inescapable implication of this model is that some form of contact, and potentially interraction, between the intrusive, expanding populations of anatomically modern hominids and the local, indigenous populations of archaic Neanderthals must have occurred—presumably at many times and places, and over effectively the whole of the geographical range occupied by the expanding modern populations. This particular scenario has provided the inspiration for a number of popular novels (such as William Golding's *The Inheritors* and Jean Auel's *The Clan of the Cave Bear*) but remains surprisingly poorly studied from the perspective of the archaeological evidence.

Over the past decade, evidence for this kind of chronological overlap, contact and apparent interaction between the final 'archaic' and earliest anatomically modern populations has been claimed from several different regions of Europe (e.g. Allsworth-Jones 1986, 1990; Kozlowksi 1988, 1990; Harrold 1989; Otte 1990; Mussi, 1990; Goia 1990; Valoch 1990; Demars 1990; Demars & Hublin 1989; Hublin 1990; Mellars 1989a, 1991). By far the clearest evidence in this context comes from the extreme western fringes of Europe, centred on the Perigord and adjacent provinces of southwest France. The evidence resides, essentially, in the demonstrable contemporaneity in this region of two quite distinct and sharply contrasting technological patterns, represented on the one hand by the classic Aurignacian industries (discussed in the preceding section), and on the other hand by those of the so-called 'Châtelperronian' or 'Lower Perigordian' group. The juxtaposition of these two assemblages raises a number of intriguing issues, which are worth examining fairly closely.

1 On the basis of simple technological and geographical criteria alone, there can be no serious doubt that the Aurignacian and Châtelperronian industries were the products of separate human populations within the southwestern French sites. The distinctive 'type fossils' which define the two industries (i.e. Châtelperron points in the case of the Châtelperronian, as opposed to various forms of nosed and carinate scrapers, Aurignacian blades, 'Dufour' and 'Font Yves' bladelets, split-base bone points etc. in the Aurignacian: see Figures 3 and 8) show mutually exclusive distributions (at least in material from the most recently excavated sites) and there is further evidence that both the basic techniques of flake and blade production and the specific sources exploited for lithic raw materials in the two variants were significantly different (de Sonneville-Bordes 1960; Harrold 1989; Demars 1990; Demars & Hublin 1989; Pelegrin 1990). Perhaps most significantly, the overall geographical distributions of the two industries are radically different: whereas (as noted above) the

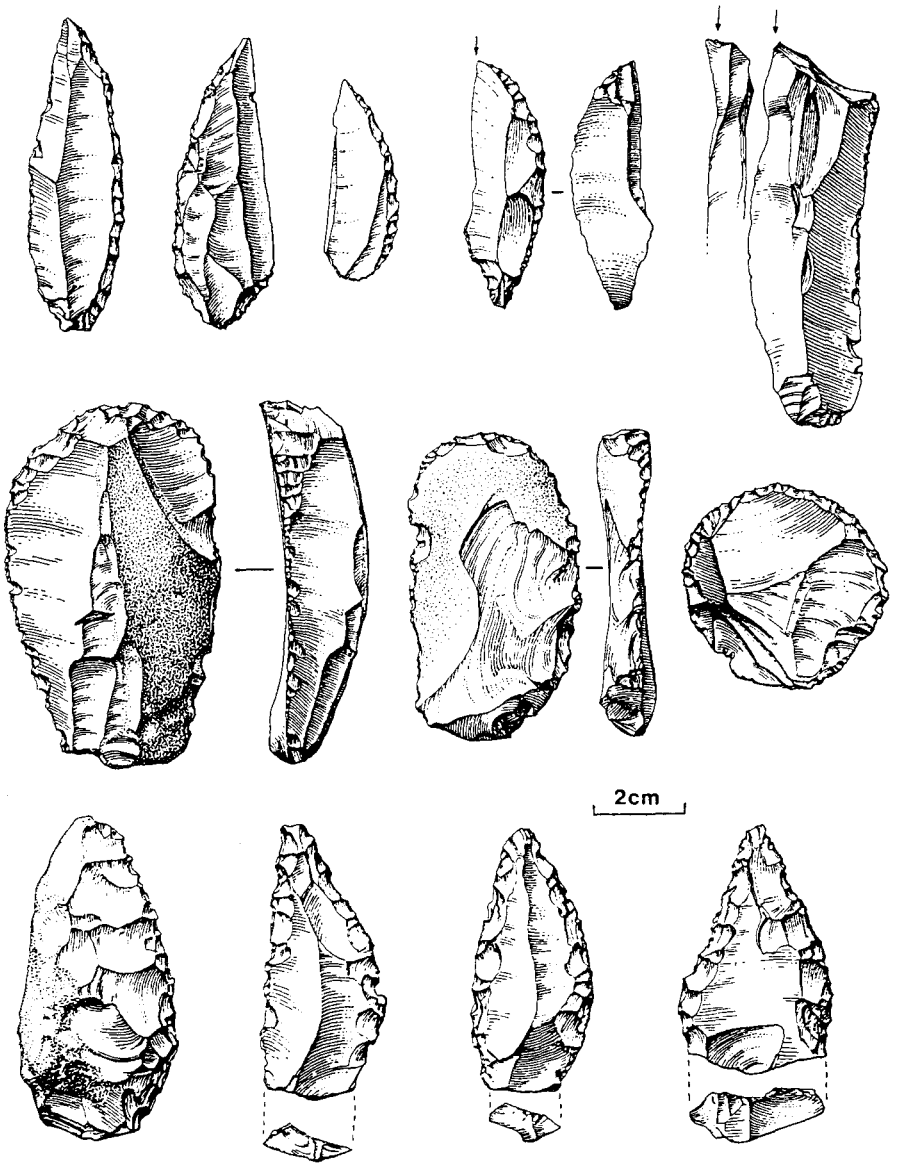

Figure 8. Châtelperronian flint artefacts from the Grotte du Renne, Arcy-sur-Cure, Central France, showing a combination of Upper Palaeolithic and Mousterian forms (after Leroi-Gourhan & Leroi-Gourhan 1964).

Aurignacian has a distribution extending over effectively the whole of Western, Central and Eastern Europe, the Châtelperronian is restricted to a relatively small zone confined entirely to the western and central parts of France (to the west of the Rhône valley) and penetrating for a short distance into the adjacent parts of the Pyrenees and northern Spain (see Figure 5).

2 The existence of a substantial period of overlap between the Aurignacian and Châtelperronian populations can now be demonstrated from several different aspects of the chronological data. In addition to correlations based on the detailed climatic and vegetational sequences recorded in the different sites (Leroyer & Leroi-Gourhan 1983; Leroyer 1988) we now have evidence from at least three sites in southern France and northern Spain where discrete levels of Châtelperronian and Aurignacian industries occur clearly *interstratified* within the same stratigraphic sequences—notably at the Roc de Combe and Le Piage in southwest France, and at El Pendo in Cantabria (Harrold 1989; Demars 1990). The available radiocarbon evidence admittedly remains rather sparse, and potentially ambiguous, for the southwest French sites (see Figure 7). From the immediately adjacent areas of both the Mediterranean coast and Cantabria however there is now clear radiocarbon evidence that typically Aurignacian industries were being manufactured (as noted earlier) by at least 38–40,000 BP —i.e. clearly *preceding* by at least 4000–5000 years the dates for typical Châtelperronian industries at sites such as Lest Cottés and Arcy-sur-Cure in western and central France (Bischoff *et al.* 1989; Cabrera Valdes & Bischoff 1989; Harrold 1989; Farizy 1990). From the combined palaeoclimatic, stratigraphic and radiocarbon evidence, there can be no serious doubt that the time ranges of the Aurignacian and Châtelperronian industries must have overlapped within these extreme western zones of Europe for at least several thousand years.

3 The crucial importance of this demonstrable chronological overlap of the Aurignacian and Châtelperronian industries in western Europe lies in the fact that there is now virtually conclusive evidence that these two technologies were the product of sharply contrasting biological populations within this region. As discussed above, all of the available skeletal evidence (from both France itself and other regions of Europe) suggests that the Aurignacian industries were the product of fully anatomically modern populations (Howell 1984; Stringer *et al.* 1984; Smith 1984; Gambier 1989; Demars & Hublin 1989; Hublin 1990). By contrast, there is now explicit evidence from the hominid remains recovered from Saint-Césaire (Figure 4) (as well as from the series of human teeth recovered from the earlier excavations at Arcy-sur-Cure) that the populations

responsible for the Châtelperronian industries were of distinctively archaic, essentially 'classic' Neanderthal type (Lévêque & Vandermeersch 1980; Stringer *et al.*, 1984; Leroi-Gourhan 1958). If this evidence is accepted at face value, then we would seem to have direct and explicit evidence for the effective coexistence of these two biologically contrasting populations within these extreme western fringes of Europe, over a very substantial span of time.

What has not always been so clearly recognized in the earlier literature is that these specifically 'archaic' associations of the Châtelperronian industries had already been predicted—several decades before the discovery of the Saint-Césaire skeleton—purely on the basis of the technology of these industries. As long ago as 1954 François Bordes argued that many of the distinctive technological features of the Châtelperronian industries (such as the character of the steeply backed 'Chatelperron points', as well as the occurrence in these industries of typical side scrapers, denticulates, and even small, bifacial hand-axe forms: Figure 8) showed obvious links with the preceding Mousterian industries of the same region—especially with those of the 'Mousterian of Acheulian tradition' ('MTA') group (Bordes 1954–55, 1958, 1968, 1972). In a later paper, I went on to add a number of further strands to these arguments, by pointing to the closely similar geographical distributions of the Châtelperronian and MTA industries (both confined strictly to areas to the west of the Rhône valley in France, and both extending into the adjacent areas of northern Spain) and arguing that the MTA industries appeared to represent the *final* stages of the local Mousterian sequence in southwest France, immediately preceding the emergence of the Châtelperronian industries (Mellars 1973). As pointed out elsewhere (Mellars 1989a) these arguments for a purely local origin for the Châtelperronian could no doubt be summed up most succinctly by observing that since the geographical distribution of the Châtelperronian is effectively restricted to these extreme, western fringes of Europe, it would be bordering on the perverse to seek an origin *outside* this region. In short, the arguments for believing that the Châtelperronian industries are the product of entirely indigenous (i.e. Neanderthal) populations within western Europe can be supported equally strongly on the basis of both the direct skeletal associations of the industries (at Saint-Césaire and Arcy-sur-Cure) and the basic technology, chronology and spatial distribution of the industries themselves.

4 The final, and in some ways most intriguing point to be emphasized here is that this period of overlap between the Aurignacian and Châtelperronian populations in western Europe would seem to be reflected in various forms of interaction or 'acculturation' between the two populations. As discussed

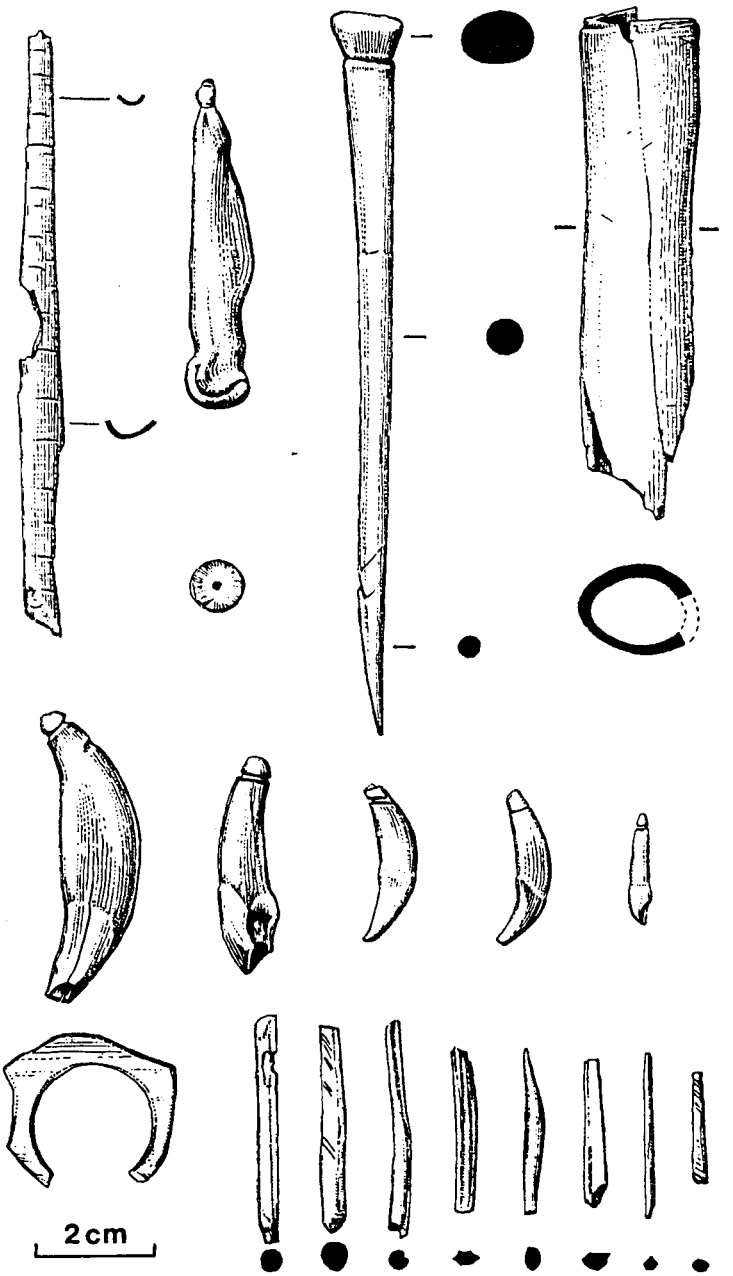

Figure 9. Bone artefacts and animal-tooth pendants from the Châtelperronian levels at Arcy-sur-Cure, Central France (ca. 33–34,000 BP) (after Leroi-Gourhan & Leroi-Gourhan 1964).

in more detail elsewhere (e.g. Harrold 1989; Mellars 1989a, 1991; Farizy 1990) it is now clear that while the basic technological roots of the Châtelperronian industries lie clearly within the immediately preceding Mousterian industries (as discussed above), many of the more specific features of these industries are of distinctively 'Upper Palaeolithic' type. This applies not only to the strong component of typically blade technology apparent in the majority of the Châtelperronian assemblages, but also to the presence of highly typical and abundant forms of both end scrapers and burins and—in at least some sites—a range of simple but extensively shaped bone and antler tools, and even 'personal ornaments', in the form of carefully grooved and perforated animal teeth (Figure 9) (Harrold 1989; Farizy 1990; Leroi-Gourhan & Leroi-Gourhan 1964). The crucial point to emphasize in this context is that all of these specifically Upper Palaeolithic elements in the Châtelperronian would appear to have developed at a relatively late stage—certainly long after the initial appearance of fully Aurignacian industries in northern Spain, and most probably while Aurignacian populations were already present in at least the southeastern parts of France (Leroyer & Leroi-Gourhan 1983; Leroyer 1988; Cabrera Valdes & Bischoff 1989). Exactly how these processes of interaction and apparent 'acculturation' between the final Neanderthal and earliest anatomically modern populations should be visualized remains, perhaps, one of the most enigmatic and intriguing issues in recent human evolution (see Graves 1991 and associated comments for further discussion of this point). But there seems little doubt that this emergence of typically Upper Palaeolithic technological features amongst the final Neanderthal populations of western Europe can be explained much more economically by the action of various contact and acculturation processes of some kind than by a purely spontaneous 'invention' of Upper Palaeolithic technology on the part of the final Neanderthal communities themselves.

The final question of how this kind of coexistence between the two populations could be maintained in ecological and demographic terms remains, perhaps, the most difficult issue to answer from the available archaeological evidence. At present we are still remarkably ignorant as to many of the most basic adaptive and organizational features of the Châtelperronian populations—largely reflecting the general poverty of the faunal material recovered from the majority of these sites and the lack (as yet) of detailed studies of the available economic data. One possibility, of course, is that the Châtelperronian and early Aurignacian groups were adapted to very different foraging and subsistence strategies—with the Aurignacian perhaps focusing on the specialised hunting of reindeer herds along the major migration trails (such as the valleys of the Dordogne and

the Vézère) while the Châtelperronian groups were adapted to more generalized, broad-spectrum animal exploitation, perhaps still dependent partially on scavenging rather than on the deliberate and 'strategic' hunting of game. The very generalized faunal assemblages recovered from the Châtelperronian levels at Saint-Césaire, Châtelperron, Les Cottés, Trou de La Chèvre etc. (in each case showing more or less balanced frequencies of horse, bovids, reindeer etc.) could be held to support this suggestion. Another possibility is that the overall levels of population density of the two populations—and the highly mobile patterns of seasonal and annual foraging strategies practised by the two groups—were such that there was rarely any direct competition between the two groups either for the exploitation of particular resources, or for the simultaneous occupation of the same economic territories. The evidence for the close interstratification of Aurignacian and Châtelperronian levels recently documented at the Roc de Combe and Le Piage (Demars 1990) might be seen as a direct reflection of these highly mobile, wide ranging, foraging patterns. Arguably—and most probably—it was only when the population density of the Aurignacian groups built up to relatively high levels during the middle and later stages of the Aurignacian (especially during the 'Aurignacian I' stage, around 32–34,000 BP) that any direct economic and social competition for the use of particular resources or particular 'social territories' would have emerged in some of the more ecologically favoured zones such as the Dordogne and Vézère valleys (de Sonneville-Bordes 1960; Mellars 1989a; Demars 1990). It is at this time, significantly, that the evidence for Châtelperronian occupation seems to become restricted mainly to the more peripheral zones of western and central France, such as the Arcy-sur-Cure caves and some of the areas immediately to the north and south of the Perigord region, as in the sites of Les Cottés, Fontenioux and Quinçay in the Department of Vienne, or at Roc de Combe and Le Piage in the Lot (Leroyer & Leroi-Gourhan 1983). Seen in these terms it is reasonable to suggest that the process of eventual population replacement of the Châtelperronian by the Aurignacian groups was a relatively gradual and progressive phenomenen—perhaps reflecting a gradual shift in population numbers and the occupation of specific territories rather than any outright 'confrontation' between the two groups (Zubrow 1989).

How far similar interaction and acculturation patterns between the final Neanderthal and earliest anatomically modern populations can be recognized in other regions of Europe still remains a matter of lively debate. Allsworth-Jones (1986, 1990), Kozlowski (1988, 1990), Valoch (1990) and several others have put forward essentially this argument for the emergence of the Szeletian and related 'leaf-point' industries of Central and Eastern Europe, arguing once again that the time-range occupied by

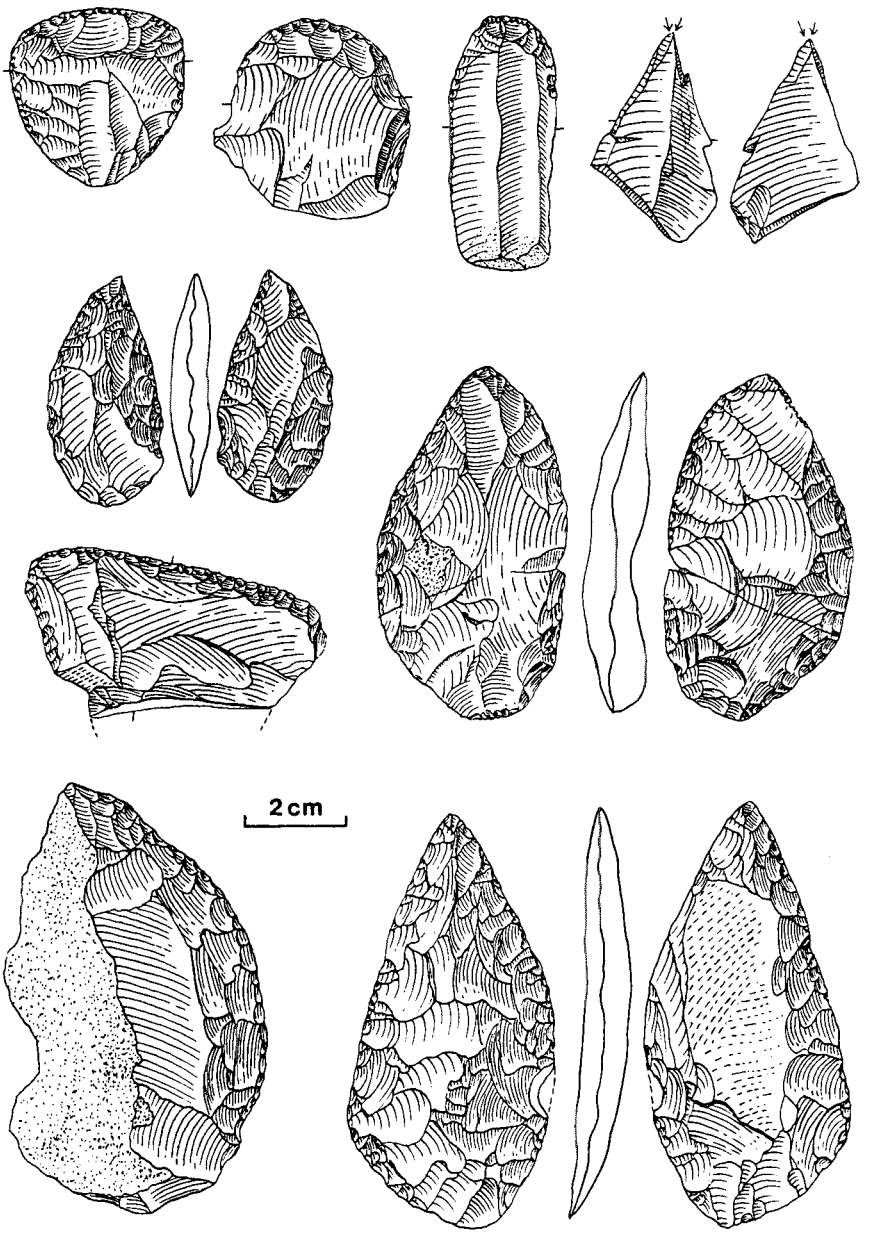

Figure 10. Bifacial leaf points and associated tools from the Szeletian site of Vedrovice V, Czechoslovakia (after Valoch 1990).

these industries almost certainly overlaps with that of the (apparently intrusive) Aurignacian industries within the same regions, and that strictly *local* roots for these distinctive industries can be seen very clearly in the technology—and spatial distribution—of the archaeological assemblages themselves (Figures 5 and 10). Mussi (1990), Goia (1990) and others have presented similar arguments for the emergence of the 'Uluzzian' industries of the Italian peninsula—again almost certainly contemporaneous with the presence of typically Aurignacian industries within the adjacent areas of the Mediterranean coast, and again showing a highly restricted geographical distribution within the Italian sites (Figure 5). Further to the east, similar patterns may be reflected in the dichotomy between the Streletskaya and Spitsinskaya industries of the south Russian Plain (Soffer 1985; Hoffecker 1988).

To summarize, recent research into the earliest stages of the Upper Palaeolithic now seems to be revealing a broadly similar pattern within the different regions of Europe. In each area there is evidence for the presence of apparently intrusive, typically 'Aurignacian' industries, apparently associated with fully anatomically modern hominids, and appearing in most regions between ca. 43,000 and 35,000 BP. Closely alongside these industries—and apparently at a broadly similar date—there is evidence for the emergence of a range of sharply contrasting forms of early Upper Palaeolithic technology, each restricted to a relatively limited and sharply prescribed geographical area (see Figure 5), and each showing a number of strong and obvious links with the latest Middle Palaeolithic technologies in the same regions. As yet it is only in Western Europe that these local technologies have been found in association with substantial and well documented human skeletal remains, but in this particular case (i.e. the Châtelperronian) the skeletal remains are of explicitly archaic, Neanderthal form. Proponents of the population dispersal hypothesis would argue that this pattern coincides closely, if not exactly, with the situation that one would predict from the scenario of a rapid dispersal of new human populations over the different regions of Europe, combined with varying degrees of chronological overlap, contact, and eventually 'acculturation' with the local, indigenous Neanderthal populations within the different regions.

Colonization Scenarios

The final question of how and why a major episode of population dispersal should have occurred at this particular point in the Upper Pleistocene has been discussed at several points in the recent literature (e.g. Zubrow 1989;

Mellars 1989a etc.). As discussed above, it is now clear from the recent dating of the large samples of skeletal remains from the sites of Skhul and Qafzeh in Israel that human populations that were essentially modern in at least most anatomical respects had become established in the Middle Eastern zone by at least 100,000 BP, and must therefore have coexisted (in at least a broad geographical sense) alongside the Neanderthal populations in the immediately adjacent areas of Europe over a period of at least 50–60,000 years (Bar-Yosef 1992). The potential reasons for the prolonged coexistence of these two populations may perhaps not be too difficult to discern. If—as most scenarios still suggest—the anatomically modern populations had evolved initially in the tropical and subtropical environments of southern Africa, then they could hardly be expected to possess the appropriate range of either biological or cultural adaptations to allow the rapid colonization of the severe periglacial environments which made up the greater part of Europe during Upper Pleistocene times. By contrast, the Neanderthal populations had evolved, and evidently flourished, in these particular environments over a period of at least 100,000 if not 200,000 years (Stringer *et al.* 1984; Hublin 1990). As I have discussed elsewhere (Mellars 1989a), it was almost certainly the complex of technological and other cultural changes inherent in the 'Upper Palaeolithic Revolution'—whatever its ultimate causes—which eventually gave some strong adaptive advantage to the anatomically modern populations in the Middle Eastern zone, and equipped them not only to colonize a complex range of entirely new glacial environments, but also to compete effectively with the local Neanderthal populations in these regions. Significantly, the initial stages of this technological and cultural revolution would seem to have occurred at least several thousand years earlier in the Middle Eastern zone (at sites such as Boker Tachtit and Ksar Akil, both apparently dated to around 45–50,000 BP) than in the adjacent zones of Europe (Mellars 1989a). The precise mechanisms and initial stimulus for this cultural transformation remain as enigmatic as ever. As discussed earlier, however, we should at least give serious consideration to the possibility that it was the emergence of more complex, essentially modern forms of language—with its attendant consequences for almost all aspects of human behaviour and organization—which played a critical, if not primary, role in this transformation (Mellars 1989a, 1991; Clark 1992 etc.).

Regardless of the initial stimulus, the actual process of population expansion may well have been greatly facilitated by climatic and ecological events around the middle of the last glaciation. It is now clear that the period centred on ca. 50–30,000 BP (i.e. the later part of stage 3 of the oxygen-isotope sequence) was marked by a series of major climatic fluctuations, during which average temperatures in many regions rose by

at least 5–6°C, and allowed the expansion of temperate woodland into many areas of Europe which had previously been dominated by periglacial tundra or steppe (Guiot *et al.* 1989). To groups who were ecologically adapted—both biologically and culturally—to the temperate environments of the east Mediterranean zone, these ecological changes would inevitably have made a process of population expansion into areas lying to the north and west easier to achieve—especially if (as the present archaeological evidence suggests) this process of population expansion extended initially along the north Mediterranean littoral zone, from the Balkans, through northern Italy, to northern Spain. It may well be that the same ecological changes would have served to destabilize some of the specific ecological and cultural adaptations of the local Neanderthal populations in these regions, leading either to significant shifts in the geographical ranges occupied by individual groups, or perhaps even to major episodes of population decline. Zubrow (1989) has recently argued that it would require little more than a relatively minor shift in relative birth/death rates between the two populations (i.e. Neanderthal on the one hand, versus anatomically modern on the other) to lead to an effective replacement of one population by the other within specific regions of Europe within a span of at most 1,000 years.

Whether or not such a process of total demographic and biological replacement *did* in fact occur—in Europe or any other part of the world—remains, of course, the most critical and controversial element in the current debates. It is now clear however that such a process of population replacement is by no means inconceivable in either cultural or demographic terms, and could well have been achieved without any of the more dramatic scenarios of 'confrontation'—let alone mass genocide—which have been envisaged in some of the more fanciful recent discussions of the origins and dispersal of modern humans.

Note. I am indebted to Professor Janusz K. Kozlowski for discussion of many of the points raised in this paper, and for providing information on his current excavations in the Temnata Cave. I am also indebted to Alexander Marshack for providing Figure 2. An abbreviated version of this paper was presented to the Royal Society Symposium on 'The Origin of Modern Humans and the Impact of Chronometric Dating' in April 1992.

References

Aitken, M. J., Stringer, C.B. & Mellars, P. A. (eds) 1992. *The Origin of Modern Humans and the Impact of Chronometric Dating*. London: Royal Society (*Philosophical Transactions of the Royal Society*, Series B, 337, no. 1280).

Allsworth-Jones, P. 1986. *The Szeletian and the Transition from Middle to Upper Palaeolithic in Central Europe*. Oxford: Oxford University Press.

Allsworth-Jones, P. 1990. The Szeletian and the stratigraphic succession in Central Europe and adjacent areas: main trends, recent results, and problems for solution. In Mellars (ed.) 1990, 160–243.

Bard, E., Hamelin, B., Fairbanks, R. G. & Zindler, A. 1990. Calibration of the ^{14}C timescale over the past 30,000 years using mass spectrometric U-Th Ages from Barbados corals. *Nature* 345, 405–410.

Bar-Yosef, O. 1992. The role of western Asia in modern human origins. In Aitken *et al.* (eds) 1992, 193–200.

Bar-Yosef, O. & Belfer Cohen, A. 1988. The early Upper Palaeolithic in the Levantine Caves. In *The Early Upper Palaeolithic: Evidence from Europe and the Near East*, (ed. J. F. Hoffecker & C. A. Wolf), pp. 23–42. Oxford: British Archaeological Reports International Series 437.

Bednarik, R. G. 1992. Palaeoart and archaeological myths. *Cambridge Archaeological Journal* 2, 27–57.

Bickerton, D. 1990. *Language and Species*. Chicago & London: University of Chicago Press.

Binford, L. R. 1989. Isolating the transition to cultural adaptations: an organizational approach. In *The Emergence of Modern Humans: Human Biocultural Adaptations in the Upper Pleistocene* (ed. E. Trinkaus), pp. 18–41. Cambridge: Cambridge University Press.

Bischoff, J. L., Soler, N., Maroto, J. & Julia, R. 1989. Abrupt Mousterian/ Aurignacian boundary at c. 40 ka bp; accelerator 14C dates from l'Arbreda Cave (Catalunya, Spain). *Journal of Archaeological Science*, 16, 563–576.

Bordes, F. 1954–55. Les gisements du Pech de l'Azé (Dordogne). I. Le Moustérien de tradition Acheuléenne. *L'Anthropologie* 58, 401–432; 59, 1–38.

Bordes, F., 1958. Le passage du Paléolithique moyen au Paléolithique supérieur. In *Hundert Yahre Neanderthaler* (ed. G. H. R. von Koenigswald), pp. 175–181. Utrecht: Kemink en Zoon.

Bordes, F. 1968. *The Old Stone Age*. London: Weidenfeld & Nicolson.

Bordes, F. 1972. Du Paléolithique moyen au Paléolithique supérieur: continuité ou discontinuité? In *The Origin of Homo sapiens*, (ed. F. Bordes), pp. 211–218. Paris: UNESCO.

Bosinski, G. 1990. *Homo Sapiens*. Paris: Editions Errance.

Boule, M. 1909. L'Homme fossile de la Chapelle-aux-Saints (Corrèze). L'Anthropologie 25 257–271.

Brauer, G. 1989. The evolution of modern humans: a comparison of the African and non-African evidence. In Mellars & Stringer (eds) 1989, pp. 123–154.

Cabrera Valdes, V. & Bernaldo de Quiros, F. 1990. Données sur la transition entre le Paléolithique moyen et Paléolithique supérieur dans la région cantabrique: révision critique. In Farizy (ed.) 1990, 185–188.

Cabrera Valdes, V. & Bischoff, J. L. 1989. Accelerator ^{14}C dates for early Upper Palaeolithic (basal Aurignacian) at El Castillo Cave (Spain). *Journal of Archaeological Science* 16, 577–584.

Cann, R. L., Stoneking, M. & Wilson, A. C. 1987. Mitochondrial DNA and human evolution. *Nature* 325, 31–36.

Cavalli-Sforza, L. L. 1991. Genes, peoples and languages. *Scientific American*, 265 (November 1991), 72–78.

Chase, P. G. & Dibble, H. L. 1987. Middle Palaeolithic symbolism: a review of current evidence and interpretations. *Journal of Anthropological Archaeology* 6, 263–293.

Clark, G. A. & Lindly, J. M. 1989. The case for continuity: observations on the biocultural transition in Europe and Western Asia. In Mellars & Stringer (eds) 1989, 626·676.

Clark, J. D. 1981. New men, strange faces, other minds: an archaeologist's perspective on recent discoveries relating to the origins and spread of modern man. *Proceedings of the British Academy* 67, 163–192.

Clark, J. D. 1992. African and Asian perspectives on the origins of modern humans. In Aitken *et al.* (eds) 1992, 201–215.

Copeland, L. 1976. Terminological correlations in the early Upper Palaeolithic of Lebanon and Palestine. In *Deuxième Colloque sur la Terminologie de la Préhistoire du Proche Orient* (ed. F. Wendorf), pp. 35–48. Nice: International Union of Prehistoric and Proto-historic Sciences.

Davidson, I. & Noble, W. 1989. The archaeology of perception: traces of depiction and language. *Current Anthropology* 30, 125–56.

Delibrias, G. & Fontugne, M. 1990. Datations des gisements de l'Aurignacien et du Moustérien en France. In Farizy (ed.) 1990, 39–42.

Delluc, B. & Delluc, C. 1978. Les manifestations graphiques aurignaciennes sur support rocheux des environs des Eyzies (Dordogne). *Gallia Préhistoire* 21, 213–438.

Demars, P. Y. 1990. Les interstratifications entre Aurignacien et Châtelperronien a Roc de Combe et au Piage (Lot): approvisionnement en matières premières et position chronologique. In Farizy (ed.) 1990, 235–240.

Demars, P. Y. & Hublin, J.-J. 1989. La transition Néandertaliens/Hommes de type moderne en Europe occidentale: aspects paléontologiques et culterels. In *L'Homme de Néandertal, vol. 7: L'extinction* (ed. M. Otte), pp. 23–27. Liège: Etudes et Recherches Archéologiques de l'Université de Liège 34.

Farizy, C. 1990. Du Moustérien au Châtelperronien a Arcy-sur-Cure: un etat de la question. In Farizy (ed.) 1990, 281–290.

Farizy, C. (ed.) 1990. *Paléolithique Moyen Récent et Paléolithique Supérieur Ancien en Europe*. Nemours: Mémoires du Musée de Préhistoire d'Ile de France 3.

Gambier, D. 1989. Fossil hominids from the early Upper Palaeolithic (Aurignacian) of France. In Mellars & Stringer (eds) 1989, 194–211.

Gamble, C. 1986. *The Palaeolithic Settlement of Europe*. Cambridge: Cambridge University Press.

Goia, P. 1990. La transition Paléolithique Moyen/Paléolithique supérieur en Italie et la question de l'Uluzzien. In Farizy (ed.) 1990, 241–250.

Graves, P. 1991. New models and metaphors for the Neanderthal debate. *Current Anthropology* 32, 513–541.

Guiot, J., Pons, A., de Beaulieu, J. L. & Reille, M. 1989. A 140,000-year continental climate reconstruction from two European pollen records. *Nature* 338, 309–313.

Haesaerts, P. 1990. Nouvelles recherches au gisement de Willendorf (Basse

Autriche). *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique (Sciences de la Terre)* 60, 203–218.

Hahn, J. 1972. Aurignacian signs, pendants, and art objects in Central and Eastern Europe. *World Archaeology* 3, 252–266.

Hahn, J. 1977. *Aurignacien: Das Altere Jungpalâolithikum in Mittel- und Osteroupa.* Koln: Fundamenta Series A9.

Harrold, F. B. 1989. Mousterian, Châtelperronian, and Early Aurignacian in Western Europe: continuity or discontinuity? In Mellars & Stringer (eds) 1989, 677–713.

Hoffecker, J. F. 1988. Early Upper Paleolithic sites of the European USSR. In *The Early Upper Paleolithic: Evidence from Europe and the Near East* (ed. J. F. Hoffecker & C. A. Wolf), pp. 237–272. Oxford: British Archaeological Reports International Series 437.

Howell, F. C. 1984. Introduction. In *The Origins of Modern Humans: a World Survey of the Fossil Evidence* (eds F. H. Smith & F. Spencer), pp. xiii–xxii. New York: Alan R. Liss.

Hublin, J.-J. 1990. Les peuplements paléolithiques de l'Europe: un point de vue géographique. In Farizy (ed.) 1990, 29–37.

Kozlowski, J. K. 1982. *Excavation in the Bacho Kiro Cave (Bulgaria): Final Report.* Warsaw: Panstwowe Wydawnictwo Naukowe.

Kozlowski, J. K. 1988. Transition from the Middle to the early Upper Paleolithic in Central Europe and the Balkans. In *the Early Upper Paleolithic: Evidence from Europe and the Near East* (ed. J. F. Hoffecker & C. A. Wolf), pp. 193–236. Oxford: British Archaeological Reports International Series 437.

Kozlowski, J. K. 1990. A multi-aspectual approach to the origins of the Upper Paleolithic in Europe. In Mellars (ed.) 1990, 419–437.

Kozlowksi, J. K. 1992. The Balkans in the Middle and Upper Palaeolithic: the gate to Europe or a cul de sac? *Proceedings of the Prehistoric Society* 58, 1–20.

Leroi-Gourhan, A. 1958. Etude des restes humains fossiles provenant des grottes d'Arcy-sur-Cure. *Annales de Paléontologie (Vertèbres)* 44, 97–140.

Leroi-Gourhan, A. & Leroi-Gourhan, A. 1964. Chronologie des grottes d'Arcy-sur-Cure (Yonne). *Gallia Préhistoire* 7, 1–64.

Leroyer, C. 1988. Des occupations castelperroniennes et aurignaciennes dans leur cadre chrono-climatique. In *L'Homme de Néandertal, vol. 8, La Mutation*, (ed. M. Otte), pp. 103–108. Liège: Etudes et Recherches Archéologiques de l'Université de Liège 35.

Leroyer, C. & Leroi-Gourhan, A. 1983. Problèmes de chronologie: le castelperronien et l'aurignacien. *Bulletin de la Société Préhistorique Française* 80, 41–44.

Lévêque, F. & Vandermeersch, B. 1980. Découverte de restes humains dans un niveau castelperronien à Saint-Césaire (Charente-Maritime). *Comptes Rendus de l'Académie des Sciences de Paris*, series 2, 291, 187–189.

Lieberman, P. 1989. The origins of some aspects of human language and cognition. In Mellars and Stringer (eds) 1989, pp. 391–414.

Lieberman, P. 1990. *Uniquely Human: the Evolution of Speech, Thought, and Selfless Behavior.* Cambridge (Mass.) & London: Harvard University Press.

Lucotte, G. 1989. Evidence for the paternal ancestry of modern humans: evidence

from a Y-chromosome specific sequence polymorphic DNA probe. In Mellars & Stringer (eds) 1989, pp. 39–46.

Maddison, D. R. 1991. African origin of human mitochondrial DNA reexamined. *Systematic Zoology* 40, 355–363.

Marks, A. E. & Ferring, C. R. 1988. The early Upper Paleolithic of the Levant. In *The Early Upper Paleolithic: Evidence from Europe and the Near East* (ed. J. F. Hoffecker & C. A. Wolf), pp. 43–72. Oxford: British Archaeological Reports International Series 437.

Marshack, A. 1972. *The Roots of Civilization*. New York: McGraw-Hill.

Marshack, A. 1990. Early hominid symbols and evolution of the human capacity. In Mellars (ed.) 1990, 457–498.

Mellars, P. A. 1973. The character of the Middle-Upper Palaeolithic transition in southwest France. In *The Explanation of Culture Change* (ed. C. Renfrew), pp. 255–276. London: Duckworth.

Mellars, P. A. 1989a. Major issues in the emergence of modern humans. *Current Anthropology* 30, 349–385.

Mellars, P. A. 1989b. Technological changes across the Middle-Upper Paleolithic transition: technological, social, and cognitive perspectives. In Mellars & Stringer (eds) 1989, 338–365.

Mellars, P. A. 1990a. Comment of radiocarbon-accelerator dating of Roc de Combe samples. *Archaeometry* 32, 101–102.

Mellars, P. A. (ed.) 1990b. *The Emergence of Modern Humans: an Archaeological Perspective*. Edinburgh: Edinburgh University Press.

Mellars, P. A. 1991. Cognitive changes and the emergence of modern humans in Europe. *Cambridge Archaeology Journal* 1, 63–76.

Mellars, P. A., Bricker, H. M., Gowlett, J. A. J. & Hedges, R. E. M. 1987. Radiocarbon accelerator dating of French Upper Palaeolithic sites. *Current Anthropology* 28, 128–133.

Mellars, P. A. & Stringer, C. B. (eds) 1989. *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans*. Edinburgh: Edinburgh University Press.

Mellars, P. A. & Tixier, J. 1989. Radiocarbon-accelerator dating of Ksar 'Aqil (Lebanon) and the chronology of the Upper Palaeolithic sequence in the Middle East. *Antiquity* 63, 761–768.

Mercier, N., Valladas, H., Joron, J. L., Reyss, J. L., Lévêque, F. & Vandermeersch, B. 1991. Thermoluminescence dating of the late Neanderthal remains from Saint-Césaire. *Nature* 351, 737–739.

Mountain, J. L., Lin, A. A., Bowcock, A. M. & Cavalli-Sforza, L. L. 1992. Evolution of modern humans: evidence from nuclear DNA polymorphisms. In Aitken *et al.* (eds) 1992, 159–165.

Movius, H. L. Jr. 1975. Summary of the stratigraphic sequence. In *Excavation of the Abri Pataud, Les Eyzies (Dordogne)* (ed. H. L. Movius), pp. 7–18. Cambridge (Mass.): Peabody Museum of Archaeology and Ethnology.

Mussi, M. 1990. Le peuplement de l'Italie à la fin du Paléolithique moyen et au début du Paléolithique supérieur. In Farizy (ed.) 1990, 251–262.

Ohnuma, K. & Bergman, C. A. 1990. A technological analysis of the Upper Palaeolithic levels (XXV–VI) of Ksar Akil, Lebanon. In Mellars (ed.) 1990, 56–80.

Otte, M. 1990. From the Middle to the Upper Palaeolithic: the nature of the transition. In Mellars (ed.) 1990, 438–456.

Pelegrin, J. 1990. Observations technologiques sur quelques séries du Châtelperronien et du MTA B du sud-ouest de la France: une hypothèse d'évolution. In Farizy (ed.) 1990, 195–201.

Pfeiffer, J. E. 1982. *The Creative Explosion: an Enquiry into the Origins of Art and Religion*. New York: Harper & Row.

Smith, F. H. 1984. Fossil hominids from the Upper Pleistocene of Central Europe and the origin of modern Europeans. In *The Origins of Modern Humans: A World Survey of the Fossil Evidence* (ed. F. H. Smith & F. Spencer), pp. 137–210. New York: Alan R. Liss.

Smith, F. H. 1991. The Neandertals: evolutionary dead ends or ancestors of modern people? *Journal of Anthropological Research* 47, 219–238.

Soffer, O. 1985. *The Upper Paleolithic of the Central Russian Plain*. Orlando, Academic Press.

Sonneville-Bordes, D. de 1960. *Le Paléolithique Supérieur en Périgord*. Bordeaux: Delmas.

Spencer, F. 1984. The Neanderthals and their evolutionary significance: a brief historical survey. In *The Origins of Modern Humans: a World Survey of the Fossil Evidence* (ed. F. H. Smith & F. Spencer) pp. 1–49. New York: Alan R. Liss.

Stoneking, M. & Cann, R. L. 1989. African origin of human mitochondrial DNA. In Mellars & Stringer (eds) 1989, 17–30.

Stoneking, M., Sherry, S. T., Redd, A. J. & Vigilant, L. 1992. New approaches to dating suggest a recent age for the human mtDNA ancestor. In Aitken *et al.* (eds) 1992, 167–175.

Stringer, C. B. 1990. The emergence of modern humans. *Scientific American* 263 (December 1990), 68–74.

Stringer, C. B. & Andrews, P. 1988. Genetic and fossil evidence for the origin of modern humans. *Science* 239, 1263–1268.

Stringer, C. B., Hublin, J.-J. & Vandermeersch, B. 1984. The origin of anatomically modern humans in Western Europe. In *The Origins of Modern Humans: A World Survey of the Fossil Evidence* (ed. F. H. Smith & F. Spencer), pp. 51–135. New York: Alan R. Liss.

Templeton, A. R. 1993. The 'Eve' hypotheses: a genetic critique and reanalysis. *American Anthropologist* 95, 51–72.

Thorne, A. G. & Wolpoff, M. H. 1992. The multiregional evolution of humans. *Scientific American* 266(4) (April 1992), 28–33.

Valoch, K. 1983. L'origine des différents technocomplexes du Paléolithique supérieur en Morave. In *Aurignacien et Gravettien en Europe*, vol. 2, (ed. L. Banesz & J. K. Kozlowksi), pp. 371–378. Liège: Etudes et Recherches Archéologiques de l'Université de Liège 13.

Valoch, K. 1990. La Morave il y a 40 000 ans. In Farizy (ed.) 1990, 115–124.

Vandermeersch, B. 1989. The evolution of modern humans: recent evidence from southwest Asia. In Mellars and Stringer (eds.) 1989, pp. 155–164.

Wainscoat, J. S., Hill, A. V. S., Thein, S. L., Flint, J., Chapman, J. C., Weatherall, D. J., Clegg, J. B. & Higgs, D. R. 1989. Geographic distributions

of alpha- and beta-globin gene cluster polymorphisms. In Mellars & Stringer (eds) 1989, 39–46.

White, R. 1989. Production complexity and standardization in early Aurignacian bead and pendant manufacture: evolutionary implications. In Mellars & Stringer (eds) 1989, 366–390.

Wilson, A. C. & Cann, R. L. 1992. The recent African genesis of humans. *Scientific American* 266 (April 1992), 22–27.

Wolpoff, M. H. 1989. Multiregional evolution: the fossil alternative to Eden. In Mellars & Stringer (eds) 1989, 62–108.

Zubrow, E. 1989. The demographic modeling of Neanderthal extinction. In Mellars & Stringer (eds) 1989, 212–231.